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<p><b>(21) International Application Number:</b> PCT/EP92/00696 <b>(22) International Filing Date:</b> 25 March 1992 (25.03.92) <b>(30) Priority data:</b> 9106511.0 27 March 1991 (27.03.91) GB <b>(71) Applicant (for all designated States except US):</b> LINGNER + FISCHER GMBH [DE/DE]; Hermannstrasse 7, D-7580 Buehl (DE). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only) :</b> HALM, Hans [DE/DE]; Castroper Strasse 34, D-4690 Herne 1 (DE). <b>(74) Agent:</b> WALKER, Ralph, Francis; Corporate Patents, Great Burgh, Yew Tree Bottom Road, Epsom, Surrey KT18 5XQ (GB).</p>		<p><b>(81) Designated States:</b> AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), MC (European patent), NL (European patent), SE (European patent), US.  <b>Published</b> <i>With international search report.</i></p>
<p><b>(54) Title:</b> TOOTHBRUSH WITH RESILIENTLY FLEXIBLE HEAD</p> <div data-bbox="505 1316 1159 1640"> </div> <p><b>(57) Abstract</b></p> <p>A toothbrush, having a handle (12) and at one end thereof a bristle-bearing head (11), wherein the head (11) is in the form of two or more segments (15) flexibly and/or resiliently linked to each other and/or to the handle (12), one or more of the segments (15) being bristle bearing.</p>		

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**Toothbrush with resiliently flexible head.**

The present invention relates to a novel article, being a toothbrush, and in particular to a toothbrush having a  
5 flexible zone in its head.

When brushing one's teeth, particularly with a conventional toothbrush having a rigid head, it can be difficult to reach all parts of the teeth in order to brush the teeth  
10 satisfactorily. It is also difficult with such brushes to maintain an optimum angle between the teeth and the head of the toothbrush for effective brushing and cleaning, necessitating continual repositioning of the brush in the hand throughout the brushing process. Consequently, there  
15 is a tendency to apply excess brushing pressure to some teeth and insufficient pressure to other teeth. The resultant combination of excess brushing pressure and inadequate cleaning or bad cleaning technique can result in damage to both teeth and gums.

20

Although angled-head toothbrushes have been suggested as an attempt to overcome some of these difficulties, they do not satisfactorily meet all the requirements.

25 Proposals have also been made for toothbrushes having flexible handles or flexible zones in their handles to assist in accommodating the orientation of the bristle-bearing head of the brush to the profile of an individual's teeth and gums. Such toothbrushes are  
30 disclosed for example in EP-A-0336641, US 4520526, DE-OL-3640898, DE-OL-3612108, CH-0155730 and IT-485723.

In some circumstances it is desirable to further improve the flexibility of the head relative to the direction of the  
35 handle of the toothbrush.

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Accordingly the present invention provides a toothbrush, having a handle and at one end thereof a bristle-bearing head, wherein the head is in the form of two or more segments flexibly and resiliently linked to each other and/or to the handle, one or more of the segments being bristle-bearing.

The toothbrush head of this invention, being flexible, can flex under the action of toothbrushing so as to accommodate itself to the differing profiles of individual users' teeth. In particular, teeth generally lie in a "C" shaped curve within the upper and lower jaw, the row of teeth consequently having a convex outer curve and a concave inner curve. The flexible head of the tooth-brush of the inventors can bend to accommodate itself to both the convex and concave curves of the teeth generally better than would be the case with a conventional rigid-headed toothbrush.

In a first embodiment of this invention, the head may be formed as an integral extension to the handle. In a second embodiment the handle may be extended into the form of a frame wholly or partly surrounding the head, and to which the head is linked, preferably flexibly and resiliently. Within such a frame the head may be integrally formed, or may be made as a separate part and fastened into the frame.

The head may be in a variety of segmented forms. For example in a first form, suitable both for when the head is formed as an integral extension of the handle or when the head is surrounded by a frame, the head may have bristles mounted in one face, and the opposite face may have one or more grooves therein. In such a head the lands between the grooves comprise the segments, and flexible resilient linking occurs about the thinned regions of head material at

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the bottom of the grooves.

In this first form of head, one or more of the grooves should be transverse to the longitudinal axis of the handle, 5 to provide flexibility of the head in a plane containing this axis. Additionally or alternatively there may be one or more grooves aligned parallel to the longitudinal axis of the handle and/or one or more grooves aligned. Preferably there are only transverse grooves. Suitably there need be 10 only one such transverse groove.

In this first form of head, the depth and/or width of the grooves, and/or the frequency of the grooves per unit distance, along the length and/or across the breadth of the 15 head may be varied. By variation in this way the flexibility and/or resilience of linking and consequently of the whole head along the length and/or across the breadth of the head may be varied. For example by having deeper grooves at the end of the head furthest from the handle, the 20 head can be made to be more flexible at this end. Preferably flexibility and/or resilience only along the length of the head is controlled in this way.

In this first, grooved, form of head, one or more of the 25 grooves may be wholly or partly filled with an elastomeric material. In this way too the flexibility and/or resilience of the head may be varied and contamination of the grooves by for example toothpaste deposits etc may be reduced or avoided completely. The colour of the elastomeric material 30 may be the same as that of the material of the head, or it may be different thereby achieving a distinctive striped or otherwise patterned appearance.

When the head is of the above described grooved form, and is 35 wholly or partly surrounded by a frame, the frame preferably completely surrounds the head. The head may be linked to

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the frame handle at various points around the perimeter of the head, but is preferably linked to the frame at one or more points in a plane that includes the longitudinal axis of the handle. The head may alternatively or additionally  
5 be linked at points in a plane at 90° to the longitudinal axis of the handle. These links may be by bridging portions of the material of the head or frame, and by varying the dimensions of these bridging portions the degree of flexibility and/or resilience of the linking may be varied.  
10 For example the degree of flexibility and/or resilience of these links can be made such that the head may be made to rock about these links, in addition to flexing.

In a second segmented form for example, suitable for use  
15 when the head is surrounded by a frame, the head is in the form of one or more chains of bristle carriers, flexibly and resiliently linked to each other, and linked at least one end of the chain to the frame. The linking may be by bridging portions of the material of the head or frame, and  
20 by varying the dimensions the degree of flexibility and/or resilience of the linking may be varied.

In a third segmented form for example the head may be in the form of segments which are not joined to each other but are  
25 flexibly and resiliently linked to the handle or to the frame. In one such embodiment, the head may be in the form of segments linked to the handle or to the frame by thin spines, e.g. stalk-like bridging portions for example oriented inwardly from a surrounding frame. By varying the  
30 dimensions of these stalk-like bridging portions the degree of flexibility and/or resilience of the linking may be varied.

In all forms of the head in which a frame is present, the  
35 frame may bear bristles, which may have the same or different distribution, length, orientation, colour or

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stiffness to those on the head. Conveniently bristles when present on the frame may be shorter than those on the head.

The bristles may be uniformly distributed over the head, and  
5 the frame, if present, but preferably the bristles are distributed in discrete tufts. There may be one or more tufts per segment. In one embodiment of a head which is in the form of chains of linked bristle carriers, each carrier may carry one or two tufts of bristles.

10

In all forms of the toothbrush of this invention in which there is a frame, the space(s) between the head and the frame may be partly or wholly filled with a flexible and/or resilient material, which may be an elastomeric material  
15 and/or may be in the form of a thin diaphragm. By varying the degree of such filling and the material used the degree of flexibility and/or resilience of the head may be varied.

The toothbrush (i.e. the handle, head and bristles) of the  
20 invention may be made of materials which are conventional in the manufacture of toothbrushes, especially plastics materials. Suitable plastics materials include, for example, polyamides and polypropylenes. An example of a suitable polyamide is the material 'Ultramid B3' (Trade  
25 mark, marketed by BASF, Federal Republic of Germany), having a modulus of elasticity (DIN 53452) of 3000. An example of a suitable polypropylene is the material 'Novolene 1100 HX' (Trade mark, marketed by BASF, Federal Republic of Germany), which is a homopolymer and has a modulus of elasticity (DIN  
30 53457) of 1400. Such a polypropylene homopolymer may optionally be used in admixture with a polypropylene block co-polymer, such as the material 'Novolene 2500 HX' (Trade mark, marketed by BASF, Federal Republic of Germany), for example in an 80 : 20 mixture by weight (1100 HX : 2500 HX).

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The handle may be of a shape which is conventional in the manufacture of toothbrushes. It may however be advantageously made in the form described in EP-0336641-A, 5 the contents of which are included by reference, more particularly as described in column 1 lines 36 - 49 thereof.

In use, the toothbrush of this invention may be used for cleaning the teeth by an entirely conventional toothbrushing 10 hand action, preferably in a manner recommended by dental health authorities. The toothbrush of the invention may also be used in electrically driven toothbrushes.

The invention will now be described by way of example only, 15 with reference to the accompanying drawings, in which:

Fig 1 shows a toothbrush head integral with the handle and divided into segments by grooves. .

20 Fig 2 shows a toothbrush head divided into segments by grooves, and within a frame extension of the handle.

Fig 3 shows a variant of the head of Fig 2 in which the head is divided into 2 segments by a single groove.

25

Fig 4 shows a toothbrush head in the form of a chain of linked bristle carriers within a frame extension of the handle.

30 Fig 5 shows a toothbrush head in the form of segments linked to a frame extension of the handle by stalk-like bridging portions.



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Referring to Figs 1A, 1B, 1C, and 1D, a toothbrush head (11) is formed integrally at one end of a handle (12). The head (11) and handle (12) are shown in an underside view in Fig 1A, in a top view in Fig 1B and in longitudinal section 5 about the line A-A in Figs 1C and 1D.

The head (11) has two substantially parallel faces, and in a top face are mounted bristles distributed in a plurality of tufts (13). The lower face is divided by a series of 10 parallel grooves (14) transverse to the longitudinal axis A-A of the handle, into segments (15) being the lands between the grooves (14), leaving a thinned and consequently flexible and resilient region of head material (16) at the bottom of the grooves (14). The bristles (13) are mounted 15 in these segments (15).

In Figs 1C and 1D the depth of the grooves (14) is shown to decrease in the direction towards the handle (12), the deepest grooves being closest to the end of the head 20 furthest from the handle. This results in graded flexibility of the head (11), the part of the head (11) furthest from the handle (12) being the more flexible by virtue of the thinner head material (16) at the bottom of the grooves (14) in this area.

25

In Figs 1E and 1F the grooves (14) are partly filled with an elastomeric material (17), which is of a different colour to the head material, imparting a striped appearance to the underside of the head.

30

In Figs 1D and 1F the head (11) is shown as flexing under the application of pressure at the point indicated by the arrow, into a convex curve of bristle tufts (13), accommodating itself to the curve of the inner side of the 35 line of the teeth to assist thorough cleaning, whilst its resilience assists gentle cleaning.

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Referring to Figs 2A, 2B, 2C, 2D, 2E, 2F and 2G, a toothbrush head (21) is surrounded by a frame (22) extension integrally formed at one end of a handle (23), which are shown in an underside view in Fig 2A, in a top view in Fig 2B, in sections about the line A-A in Figs 2C, 2E and 2G, in a cross section about the line B-B in Fig 2D, and in an overall side view in Fig 2F.

The head (21) is flexibly and resiliently linked to the frame (22) by bridging portions (24) of thin head/handle material, at two points in line with the longitudinal axis of the head (21) and frame (22), the upper part of which may be closed with a thin diaphragm (not shown) of elastomeric material.

15

The head (21) has a construction similar to that of the head shown in Fig 1, i.e. it has two substantially parallel faces, in a top face being mounted tufts (26) of bristles, the lower face being divided into segments (27) by lateral grooves (28).

In Fig 2G, the grooves (28) are shown as being partly filled with an elastomeric material (29) of a different colour to that of the head material, imparting a striped appearance to the underside of the head (21).

In Figs 2D and 2E the head (21) is shown as flexing under the application of pressure of the point indicated by the arrow in Fig 2E, into a concave curve of bristle tufts (26), accommodating itself to the outer side of the line of teeth. Furthermore the ability of the head (21) to flex in this concave manner contributes to a gentle tooth-cleaning action. In Fig 2D the application of pressure of the point indicated by the arrow has resulted in rocking of the head (21) about the axis between the two bridging portions (24), to assist in accommodating the head (21) to the shape and

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orientation of the teeth.

Referring to Figs 3A, 3B, 3D, 3E and 3F, a toothbrush head (31) is surrounded by a frame (32) extension integrally  
5 formed with a handle (33) which are shown in an underside view in Fig 3A, in a top view in Fig 3B, in a longitudinal section about the line A-A in Figs 3C, 3D and 3F and in an overall side view in Fig 3E.

10 The head (31) is flexibly and resiliently linked to the frame (32) by bridging portions (34) of thin head/handle material, at two regions in line with the longitudinal axis of the head (31), leaving a narrow gap (35) between the head (31) and frame (32), the upper part of which may be closed  
15 with a thin diaphragm (not shown) of elastomeric material.

The head (31) has a construction similar of that of the head of Fig 2, with an upper face having tufts (36) of bristles mounted therein. The lower face is divided into two  
20 segments (37) by a single lateral groove (38).

In Fig 3F, the single lateral groove (38) is shown partly filled with an elastomeric material (39) of a colour different to that of the head material, imparting a striped  
25 appearance to the underside of the head (31).

In Fig 3D, the head (31) is shown as flexing under the application of pressure at the point indicated by the arrow into a concave fold of bristle tufts (36) accommodating  
30 itself to the outer side of the line of the teeth.

The two bridging portions (34) are wider than those shown in Fig 2, and hence the head (31) does not so readily undergo rocking motion about these bridging portions (34) as does

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the head of Fig 2.

Referring to Figs 4A, 4B, 4C, 4D, 4E and 4F, a toothbrush head (41) is surrounded by a frame (42) extension of a handle (43), which are shown in an underside view in Fig 4A, in a top view in Figs 4B and 4F, in longitudinal section about line A-A in Figs 4C and 4D and in an overall side view in Fig 4E.

10 The head (41) is in the form of a series of bristle carriers (44) which are flexibly and resiliently linked by thin bridging portions (45) to each other and to the frame (42). The bristle carriers (44) carry one or two tufts (46) of bristles. More tufts (47) of bristles are mounted on the  
15 frame (42) in an outer ring of tufts (47) which are shorter than tufts (46).

Within frame (42) there is a space (48) around the chain of bristle carriers (44), which in Fig 4F is shown filled with  
20 an elastomeric material (49) which is of a different colour to that of the frame (42) and bristle carriers (44).

In Fig 4D the head (41) is shown as flexing under the application of pressure at the point indicated by the arrow  
25 in Fig 4D into a concave curve of tufts (46) accommodating itself to the outer side of the line of the teeth. The linking of individual tufts (46) in this way assists towards a very gentle tooth cleaning action.

30 Referring to Figs 5A, 5B, 5C, 5D, 5E, 5F and 5G, a toothbrush head (51) is surrounded by a frame (52) extension of a handle (53), which are shown in an underside view in Fig 5A, in a top view in Figs 5B and 5F, in longitudinal section view about line A-A in Figs 5C, 5E and 5G, and in a

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cross sectional view in Fig 5D. The overall sideways appearance of this toothbrush is identical to Fig 2F.

The head (52) is in the form of a series of segments (54),  
5 which are flexibly and resiliently linked by stalk-like portions (55) to the frame (52), leaving a narrow gap (56) between the head (51) and the frame (52), and between the segments (54). The segments (54) carry one or more tufts (57) of bristles.

10

In Figs 5F and 5G the gap (56) is shown as being partly filled with an elastomeric material (58) which is of a different colour to that of the segments (54) and the frame (52).

15

In Figs 5D and 5E the head (51) is shown as flexing under the action of pressure of the point indicated by the arrow into a concave curve of tufts (57) accommodating itself to the outer side of the line of the teeth.

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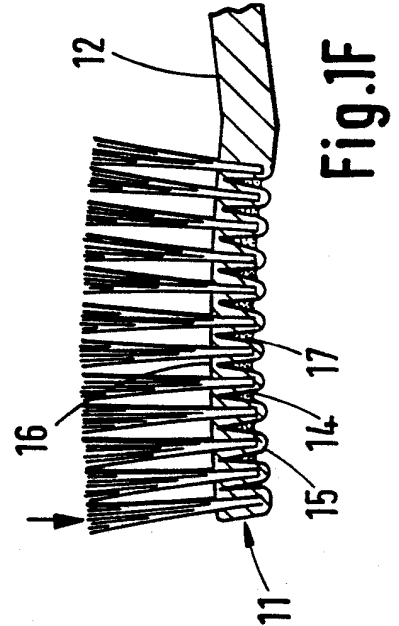
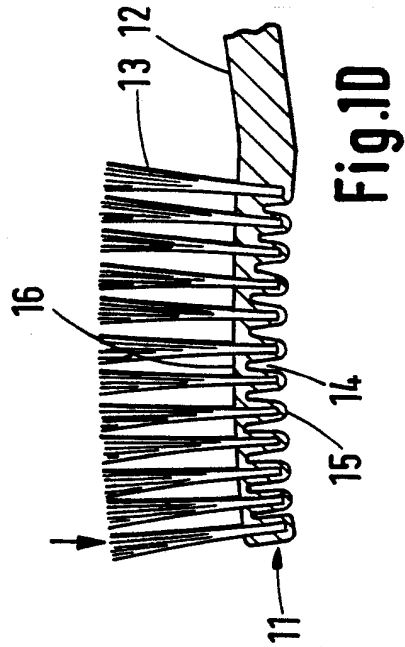
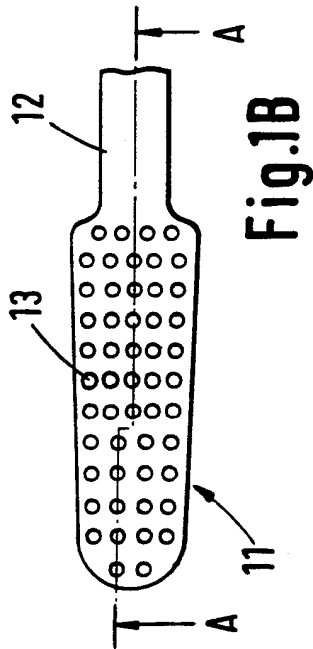
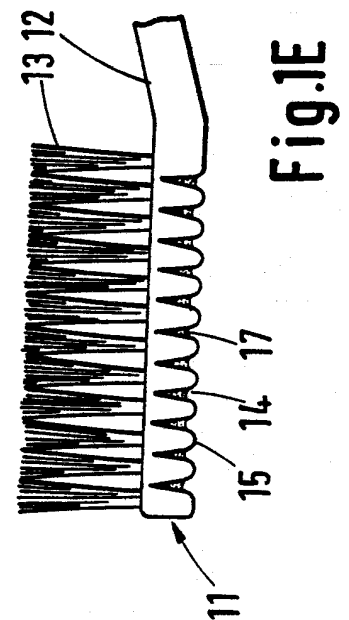
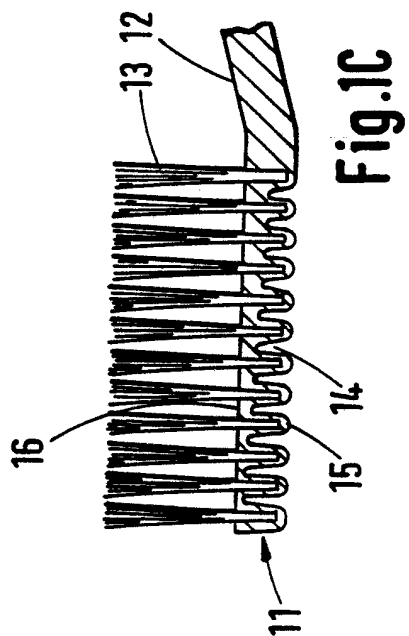
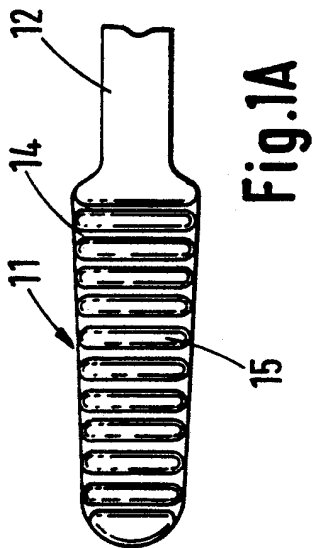
CLAIMS.

1. A toothbrush, having a handle and at one end thereof a bristle-bearing head, wherein the head is in the form of two or more segments flexibly and resiliently linked to each other and/or to the handle, one or more of the segments being bristle bearing.
2. A toothbrush according to claim 1 wherein the head is formed as an integral extension to the handle.
3. A toothbrush according to claim 1 wherein the handle is extended into the form of a frame wholly or partly surrounding the head and to which the head is flexibly and resiliently linked.
4. A toothbrush according to any one of claims 1 to 3 wherein the head has bristles mounted on one face and the opposite face has one or more grooves therein.
5. A toothbrush according to claim 4 wherein the grooves are aligned transverse to the longitudinal axis of the handle.
6. A toothbrush according to any one of the preceding claims wherein one or more of the grooves is aligned transverse to the longitudinal axis of the handle.
7. A toothbrush according to any one of claims 4, 5 or 6 having only one groove.
8. A toothbrush according to any one of claims 4, 5 or 6 in which the depth, width or frequency per unit distance along the length or across the width of the head varies with distance.
9. A toothbrush according to any one of claims 4 to 8 wherein one or more of the grooves is wholly or partly filled with an elastomeric material.
10. A toothbrush according to claim 3 wherein the frame completely surrounds the head.

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11. A toothbrush according to claim 10 wherein the head is linked to the frame at one or more points in a plane that includes the longitudinal axis of the handle.
12. A toothbrush according to claim 10 or 11 wherein the head is linked to the frame at one or more points in a plane at  $90^{\circ}$  to the longitudinal axis of the handle.
13. A toothbrush according to claim 10 wherein the head is in the form of one or more chains of bristle carriers flexibly and resiliently linked to each other and linked at least one end of the chain to the frame.
14. A toothbrush according to claim 1, 2 or 3 wherein the head is in the form of segments which are flexibly and resiliently linked to the handle or to the frame.
15. A toothbrush according to claim 14 wherein the head is in the form of segments linked to the handle or to the frame by thin spines.
16. A toothbrush according to claim 15 wherein the head is in the form of segments linked by stalk-like bridging portions to a surrounding frame.
17. A toothbrush according to claim 3 wherein the frame is bristle-bearing.
18. A toothbrush according to claim 3 wherein the space(s) between the head and the frame is(are) wholly or partly filled with a flexible and/or resilient material.

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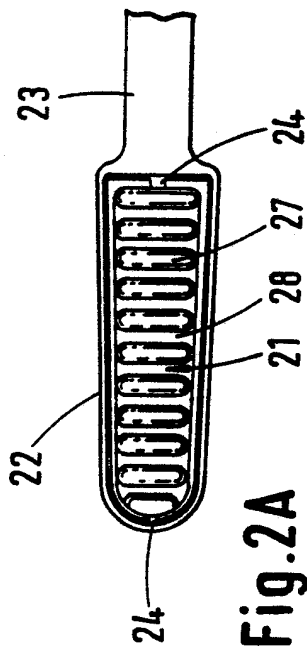


Fig. 2A

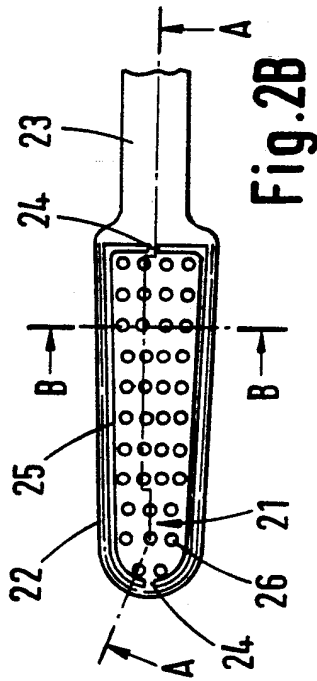


Fig. 2B

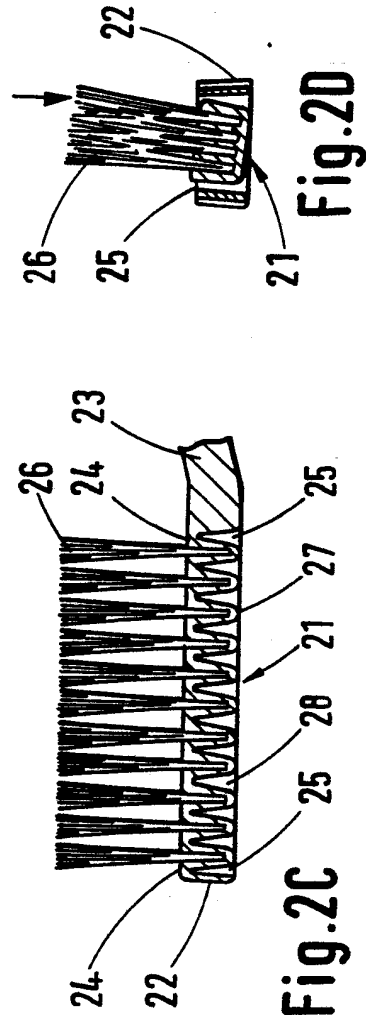


Fig. 2C

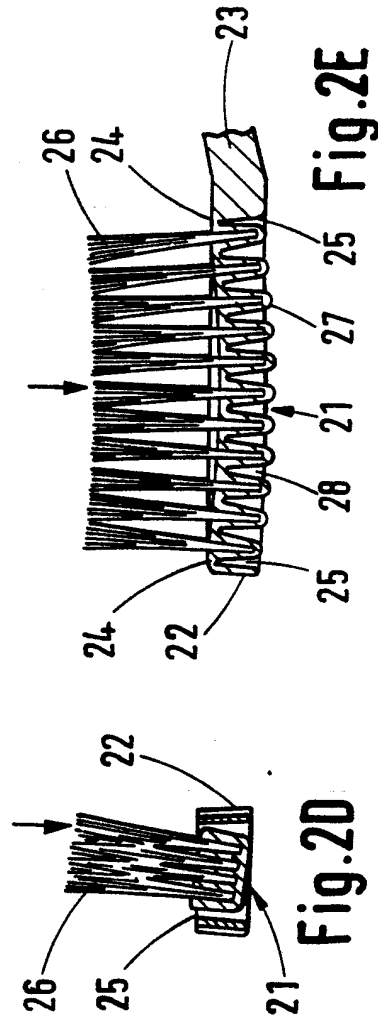


Fig. 2D

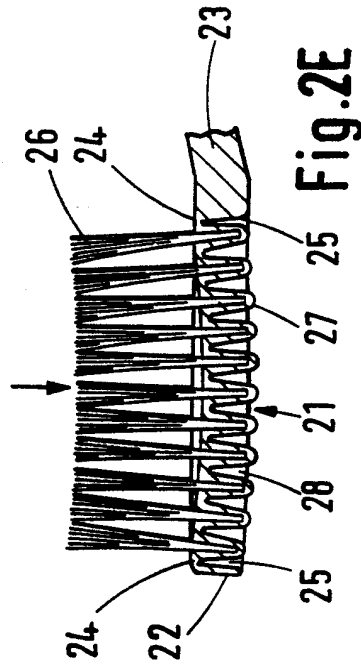


Fig. 2E

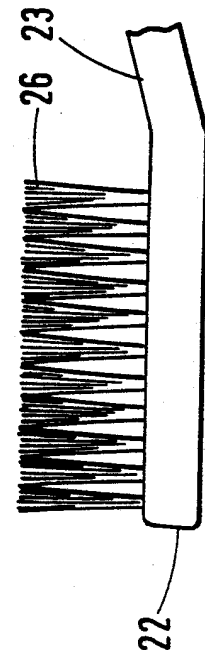


Fig. 2F

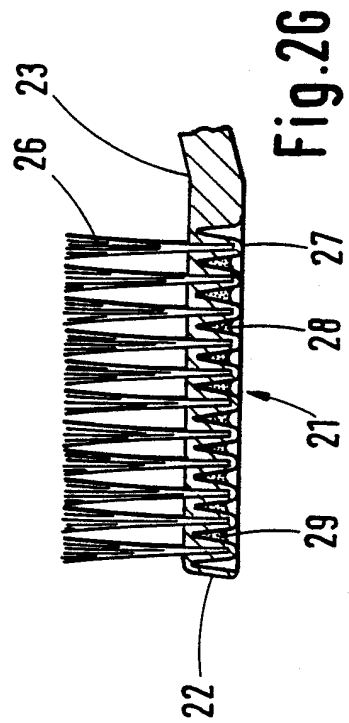
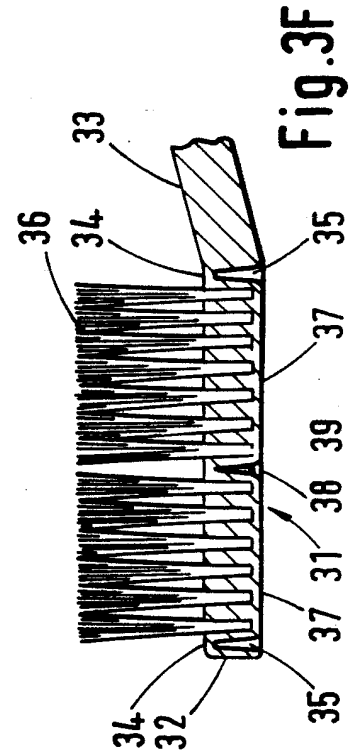
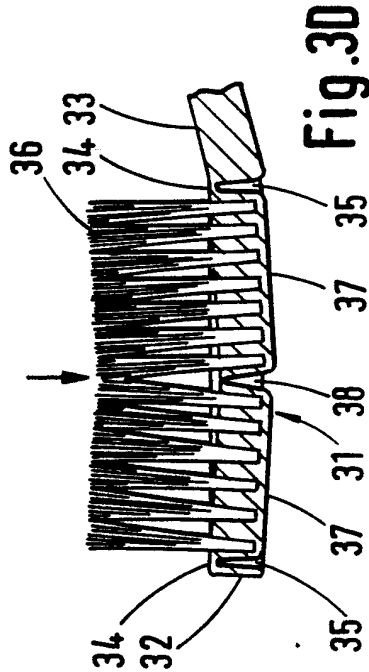
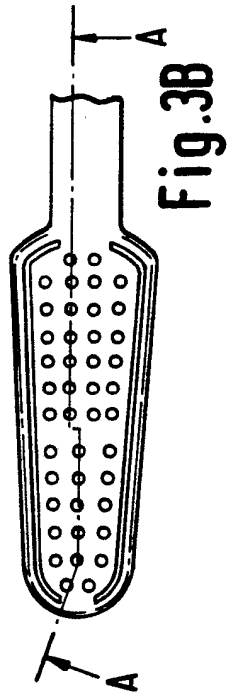
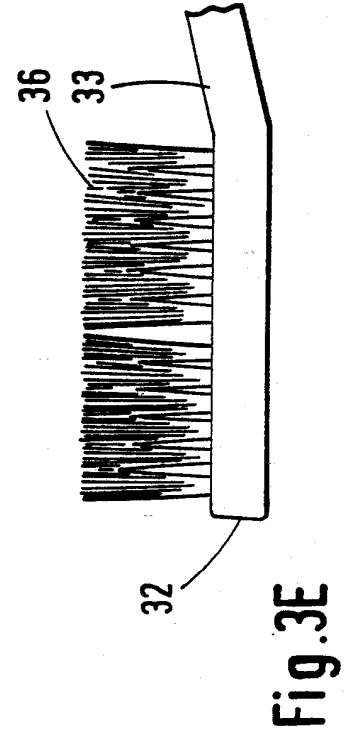
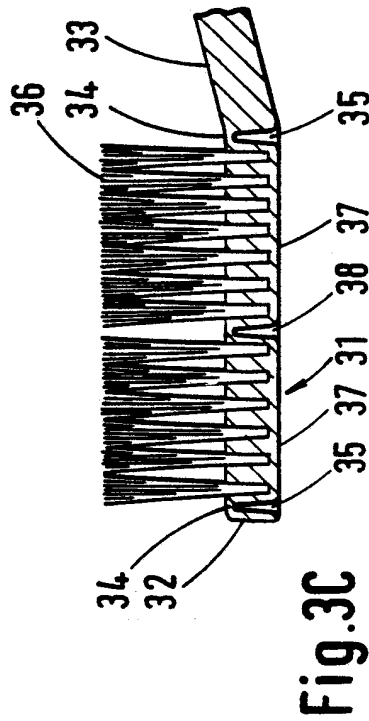
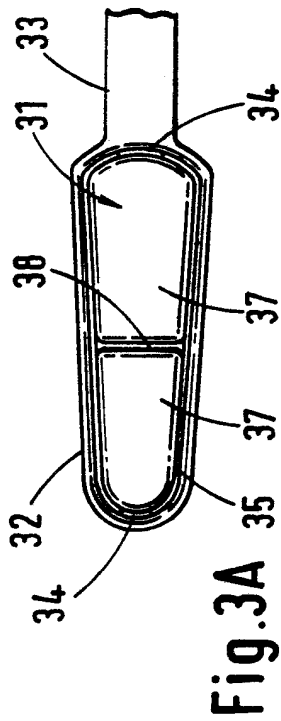
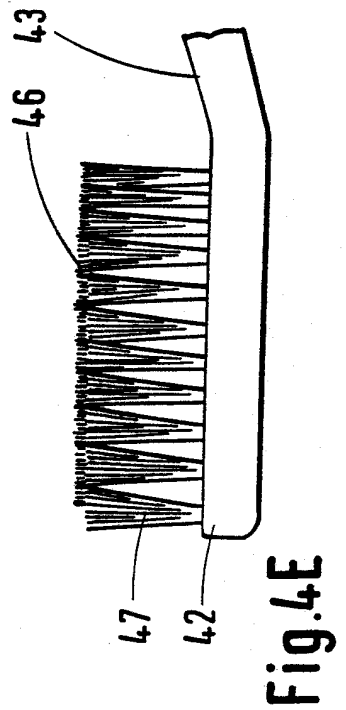
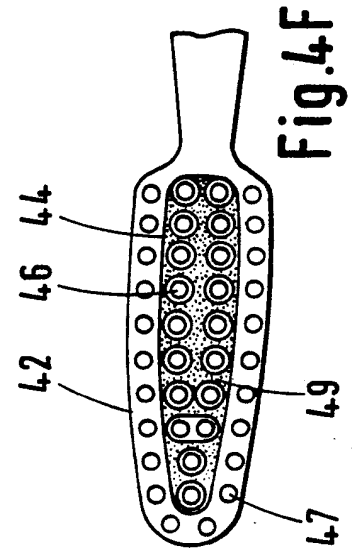
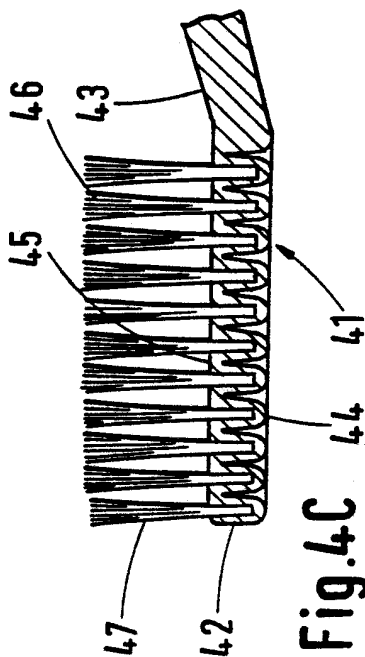
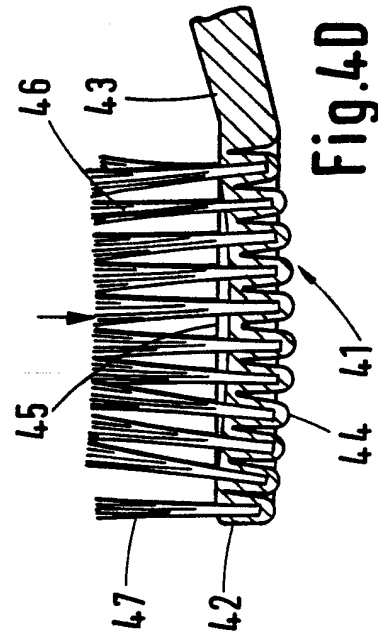
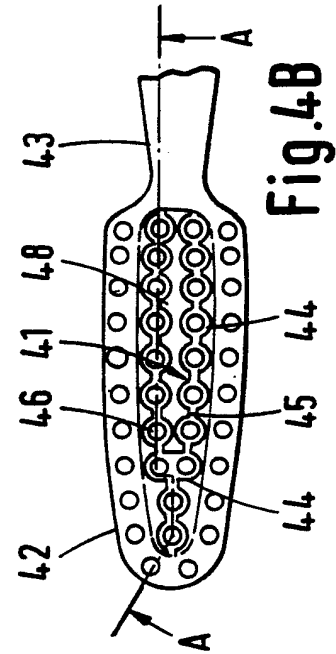


Fig. 2G

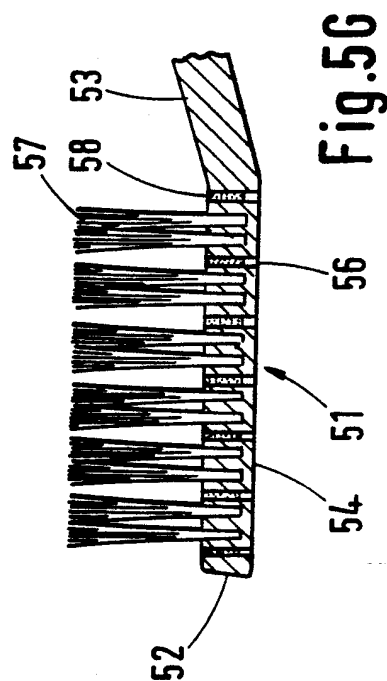
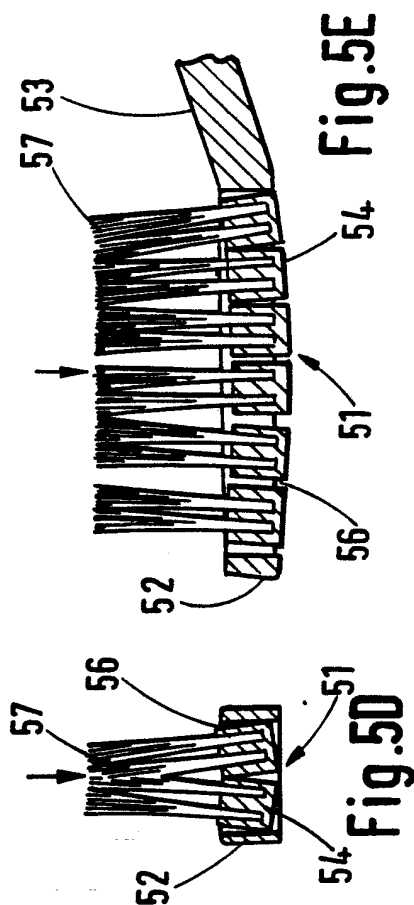
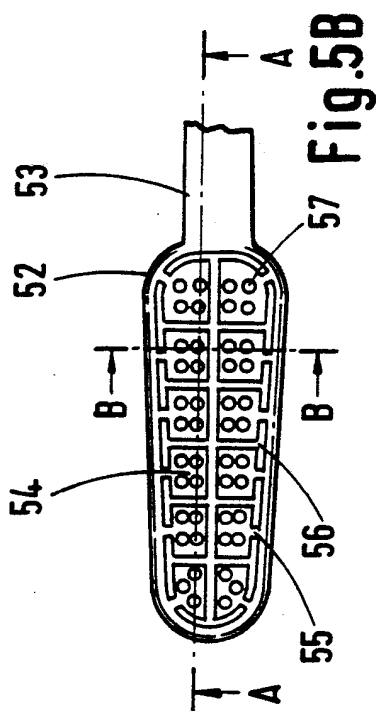
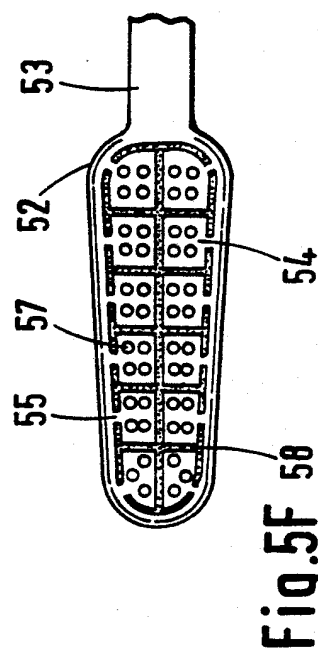
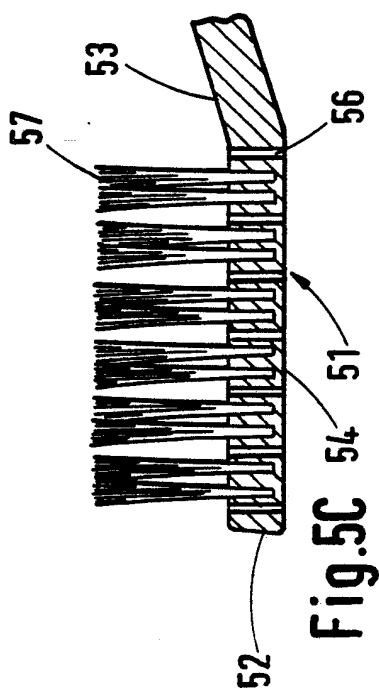
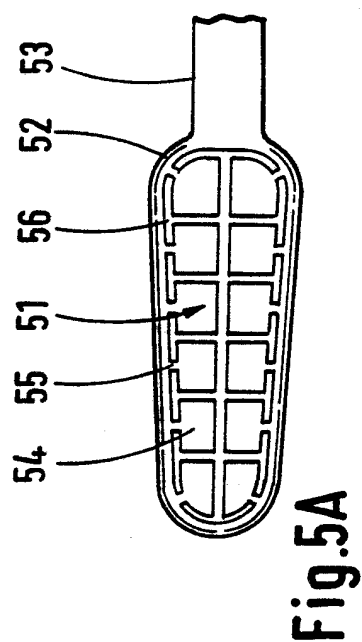
3/5



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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 92/00696

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 A46B7/06		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
Int.Cl. 5	A46B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	US,A,4 691 405 (REED) 8 September 1987 see column 4, line 3 - column 5, line 57; figures ---	1,3, 10-12,17
X Y	US,A,3 188 672 (GARY) 15 June 1965 see column 1, line 13 - column 3, line 25; figures ---	1,2,4-6, 8,14 3,15
Y	US,A,4 488 328 (HYMAN) 18 December 1984 see column 2, line 54 - column 4, line 31; figures ---	3
Y	FR,A,442 832 (PREVOST) 10 September 1912 see claim; figures ---	15
A	US,A,2 266 195 (HALLOCK) 16 December 1941 --- -/--	1
<p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
09 JUNE 1992	14. 07. 92	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	ERNST R.T. 	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	DE,B,1 233 821 (E.I. DU PONT DE NEMOURS) 9 February 1967 see figures ---	1
A	US,A,2 676 350 (BRESSLER) 27 April 1954 see figures ---	1

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.**

EP 9200696  
SA 57648

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 09/06/92

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-4691405	08-09-87	None	
US-A-3188672		None	
US-A-4488328	18-12-84	None	
FR-A-442832		None	
US-A-2266195		None	
DE-B-1233821		None	
US-A-2676350		None	